Amendments to the claims:

1. (original) A method for monitoring the operation of a continuous caster in a start-up casting mode in which molten metal is shaped in a continuous caster to form a solidifying strand product before the continuous caster reaches a predetermined minimum caster speed, the method including the following steps:

retrieving historical data consisting of multiple historical observations of process variables for a plurality of continuous caster start-up operations, the number of historical observations varying from one continuous caster start-up operation to another;

selecting a modelling set from said historical data to represent normal start-up operations of a continuous caster;

creating a synchronized data set of process trajectories from said modelling set in which the number of historical observations from each continuous caster start-up operation is scaled to correspond to a selected length of strand product;

performing a multi-way principal component analysis (MPCA) on said synchronized data set to calculate the value of principal components T and a loading matrix P for each continuous caster start-up operation to develop a multivariate statistical model of normal continuous caster start-up operations;

computing test statistics selected from the group consisting of Squared Prediction Error (SPE) and "Hotelling T" (HT) for each observation from said multivariate statistical model;

selecting control limits for said SPE and HT test statistics and their contributions;

acquiring on-line data consisting of multiple observations of said process variables observed at an elapsed time t during a start-up operation of a continuous caster;

predicting future process trajectories for said on-line data for a start-up operation of the continuous caster producing said selected length of strand product;

applying said multivariate statistical model to a matrix X_{new} of said future process trajectories to compute test statistics selected from the group consisting of Squared Prediction Error (SPE) and "Hotelling T" (HT);

comparing said test statistics computed from the matrix X_{new} to the said control limits; and

generating a detection signal, said detection signal being indicative of whether the continuous caster start-up operation is consistent with normal start-up operations in a continuous caster.

2. (original) A method according to Claim 1 in which the historical data and on-line data are selected to correspond to a start-up operation having a casting speed of at least 0.1 meter/second.

3. (original) A method according to Claim 2 in which the historical data and on-line data are selected to correspond to a start-up operation having a cast length of strand product of up to 3.2 meters.

4. (original) A method according to Claim 1 in which the process variables are selected from the group comprising: mold thermocouple readings, temperature differences between pre-defined thermocouple pairs, stopper rod postion, tundish car net weight, mold cooling water flows, temperature difference between inlet and outlet mold cooling water, casting speed, and calculated heat flux transferred through each mold face.

5. (original) A method according to Claim 1 in which synchronization of process trajectories is based on non-uniform scales in the selected strand length whereby the MPCA calculation is performed more frequently at the beginning of a start-cast operation than at the end of the start-cast operation.

6. (original) A method according to Claim 5 in which the start-cast operation is selected to begin at a casting speed of 0.1 meter/second and to end at a casting length of 3.2 meters.

7. (original) A method according to Claim 1 in which the control limits are selected to exclude 5% of the continuous casting operations which represent normal start-up operations.

8. (original) A method according to Claim 1 in which the contribution of each process variable to SPE or HT at each observation in the strand length is calculated and control limits are selected to exclude 5% of the continuous casting operations which represent normal start-up operations.

9. (original) A method according to Claim 1 in which a number of multivariate statistical models are developed each corresponding to a range of continuous caster operating conditions selected from the group comprising: grade of metal being cast and width of casting strand.

10. (original) A method according to Claim 1 in which an alarm is generated to indicate an impending start-cast breakout or abnormal situation if the SPE or HT statistic of a new start-up operation exceeds its control limit over 3 consecutive sampling intervals.

11. (original) A method according to Claim 1 in which process variables are identified as the most likely causes of abnormal behaviour based on their contributions to the SPE and HT statistics.

12. (original) A method according to Claim 11 in which the likely root causes of abnormal behaviour are identified as the process variables that have the highest ratio of the SPE or HT contribution at a current observation and at a corresponding control limit.

13. (original) A method according to Claim 1 in which the control limits of SPE, HT and their contributions are updated from current operational data.

14. (original) A method according to Claim 1 in which future process trajectories are predicted based on the assumption that future deviations from average trajectories for process variables in the historical observations will remain constant.

15. (currently amended) A system for on-line monitoring the start-up operation of a continuous caster ~~in a start-up casting mode~~, which initiates the casting process from the state of pouring liquid steel into an empty mould to reach a predetermined caster speed and achieve a stable operation, ~~in which molten metal is shaped in a continuous caster to form a solidifying strand before the continuous caster reaches a predetermined caster speed,~~ the system having

(1) a data communication module for acquiring real-time process measurements during a caster start-up operation; ~~server to supply real-time process data;~~

(2) a trajectory synchronization module for interpolating the acquired real-time process measurements based on predefined non-uniform synchronization scales

in the casting length to synchronize the process trajectories of the start-up operation;

(3) ~~a computational server for receiving real-time process data, to perform MPCA calculations and to send a detection signal; and~~ a model calculation module for conducting MPCA calculations based on the said obtained synchronized process trajectories and sending a detection signal for impending breakouts during the start-up operation; and

(4) a human machine interface ~~computer~~ for displaying current start-up operation conditions ~~based on SPE and HT test statistics for a matrix X_{new} defined according to Claim 1~~.

16. (original) A system according to Claim 15 having initiation means corresponding to a pre-defined cast width range and adapted to select a specific MPCA model associated with said pre-defined cast width range.

17. (cancelled).

18. (currently amended) A system according to Claim 15 having a visual display screen to display ~~said test statistics~~ the following information about the start-up operation: alarms of impending breakouts during the start-up operation or other abnormal start-up operations generated from the said detection signals; time duration of start-up operation and selected synchronized process trajectories within this duration, associated with upper and lower control limits for each process trajectory.

19. (currently amended) A system according to Claim 15 having means to determine whether a continuous caster operation has reached a steady state according to ~~casting indicators~~ real-time process measurements selected from the group comprising: product notification, casting speed, and strand length, whereby the said MPCA calculations are performed in a start-up state and normal PCA calculations are performed in a stable run-time state.